CLAIMS

What is claimed is:

1. A solid part, comprising a metallic monolith having a dense core surrounded by a porous periphery.

2. The part of Claim 1, wherein the porous periphery is characterized by a multitude of interconnected pores.

3. The part of Claim 2, wherein the porosity varies from more than 25% porosity near the surface to less than 5% porosity 100μm or more from the surface.

4. A solid part, comprising a shaped metallic structure having a dense core surrounded by a porous periphery characterized by a multitude of interconnected pores.

5. The part of Claim 4, wherein the porosity varies from more than 25% porosity near the surface to less than 5% porosity 100μm or more from the surface.

6. The part of Claim 4, wherein the shaped metallic structure is monolithic.

7. A solid part, comprising a metallic monolith having a dense core surrounded by a porous periphery characterized by a multitude of interconnected pores.

8. A prosthesis, comprising:

a monolithic metallic substrate having a dense core surrounded by a porous periphery; and

a coating of bioactive material on the substrate.

9. The prosthesis of Claim 8, wherein the porous periphery is characterized by a multitude of interconnected pores.

10. The prosthesis of Claim 8, wherein the bioactive material is hydroxyapatite.

11. A prosthesis, comprising:

a monolithic metallic substrate having a dense core surrounded by a porous periphery characterized by a multitude of interconnected pores; and

a coating of hydroxyapatite on the substrate.

12. A dental implant, comprising:

a monolithic metallic screw having a dense core surrounded by a porous periphery characterized by a multitude of interconnected pores; and

a coating of bioactive material on the screw.

13. The dental implant of Claim 12, wherein the metallic screw is a titanium screw.

14. The dental implant of Claim 12, wherein the bioactive material is hydroxyapatite.

15. A dental implant, comprising:

a monolithic titanium screw having a dense core surrounded by a porous periphery characterized by a multitude of interconnected pores, the porous periphery having a porosity that varies from more than 25% porosity near the surface to less than 5% porosity 100µm or more from the surface; and

a coating of hydroxyapatite on the screw.

16. A method, comprising:

compacting a metal powder; and

exposing the compacted powder to microwaves under conditions sufficient to transform the compressed powder into a monolith having a dense core surrounded by a porous periphery.

17. The method of Claim 16, wherein exposing the compacted powder to microwaves under conditions sufficient to transform the compressed powder into a monolith having a dense core surrounded by a porous periphery comprises exposing the compacted powder to microwaves at 1.0 kilowatt - 2.5 kilowatts for not more than 20 minutes.

18. A method, comprising:

transforming metal powder into a monolith having a dense core surrounded by a porous periphery; and

coating the monolith with a bioactive material.

19. A method, comprising:

pressing titanium powder into a desired shape;

exposing the compressed powder to microwaves under conditions sufficient to transform the compressed powder into a monolith having a dense metal core surrounded by a porous metal periphery; and

coating the periphery with hydroxyapatite.

20. A method, comprising:

compacting titanium powder without external heating;

microwave sintering the compacted powder to form a substrate; and

depositing hydroxyapatite on the substrate.

21. A method, comprising:

compacting titanium powder without external heating;

microwave sintering the compacted powder to form a substrate having a dense core surrounded by a porous periphery; and

depositing hydroxyapatite on the periphery of the substrate.

22. A method, comprising:

compacting titanium powder into a desire shape without external heating, the shape having a core and a periphery surrounding the core; and

sintering the compacted powder including heating the core to a temperature greater than the temperature in the periphery.

23. The method of Claim 22, wherein sintering comprises exposing the compacted powder to microwaves.

24. A method, comprising:

compacting a metal powder into a desired shape;

sintering the compacted powder with microwaves to form a sintered substrate; and

electrodepositing a bioactive material on the substrate.

25. A method, comprising:

compacting titanium particles having a particle size less than 325 mesh into a desired shape;

thermally insulating the compacted powder;

exposing the insulated compacted powder to microwaves at 1.0 kilowatt - 2.5 kilowatts for not more than 20 minutes to form a sintered substrate;

electrocrystallizing hydroxyapatite on the substrate; and

calcining the coated substrate.

26. A method, comprising:

compacting titanium particles having a particle size less than 325 mesh into a desired shape;

thermally insulating the compacted powder;

exposing the insulated compacted powder to microwaves at 1.0 kilowatt - 2.5 kilowatts for not more than 20 minutes to form a sintered substrate;

washing the substrate in an ultrasonic bath;

drying the substrate;

etching the substrate in nitric acid;

immersing the substrate as an anode in an electrolyte that includes $Ca(NO_3)_2$, and $NH_4H_2PO_4$;

immersing a cathode in the electrolyte;

generating 0.5 to 1.5 amperes of electrical current between the anode and cathode for 5-20 minutes to form a coated substrate;

drying the coated substrate; and

calcining the coated substrate at 100°C to 400°C.